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ABSTRACT

This study sought to analyze the technical problems encountered by students in a technology training course for educators. The results of the study then informed the redesign of the course for its next offering. The study collected data by both qualitative and quantitative means with the overall purpose of determining in which course modules the students encountered the most technical problems. Further data collected from the survey following the course indicated that occurrence of technical problems did not negatively impact the students' rating of the value of each module or the perceptions of the value of the course. (Contains 10 references.) (Author)

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Abstract: This study sought to analyze the technical problems encountered by students in a technology training course for educators. The results of the study then informed the redesign of the course for its next offering. The study collected data by both qualitative and quantitative means with the overall purpose of determining in which course modules the students encountered the most technical problems. Further data collected from the survey following the course indicated that occurrence of technical problems did not negatively impact the students' rating of the value of each module or the perceptions of the value of the course.

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Introduction

This paper reviews the results of a web-based course intended to teach technology skills to practicing K-12 educators. While computer-based training has long been used for training technology, new systems being developed for online courses will benefit from continued research into the practice and application of Internet technology in distance education situations. The American Federation of Teachers recommends "as we encourage experimentation in distance education, we must conduct much more rigorous evaluation of distance education programs" (p.15).

The purpose of this study was to begin an evaluation process to meet those needs. The development of this course follows a four stage process of (a) Design, (b) Development, (c) Evaluation, and (d) Revision (Willis, 1992). At the point that this paper was written, the course was undergoing the evaluation stage of the course development process. The results from the data gathered will serve to inform the course designers during the revision stage of the process.

Relevant Literature

In 1995, the Office of Technology Assessment identified technical problems as one of several barriers to technology integration in the K-12 educational practices. The Institute for Higher Education Policy (2000) identifies reliability of distance delivery system is also a benchmark for quality online education.

Technical problems while using computer technology are certainly not an uncommon occurrence. Harmes (2001) notes that in a case study on a internet based course, "the most frustrating portions of the distance learning course were reported to be

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problems with software (e.g. using AOL's browser), trouble communicating with other students, and long download times" (p. 2854). Other studies have indicated that only 20.9% of course websites have technical help functions available (Mioduser, et al., 2000).

It is possible, however, to alleviate some of the technical problems that might be encountered in online courses. The development of a course website is very similar to the development of other software. In this study, the "software" being developed was the course website, tutorial modules, and assignments. Mishra (1999) proposes that the design of software "is an ongoing conversation" (p. 231). This conversation includes the initial design of software, testing the software, presenting to clients, and other reiterative processes used to develop and refine software to meet the specified need. In terms of online courses, the clients include both the instructor and the students, thus consideration must be made for the usability needs of both the instructors and the students

Even with careful planning, testing, etc., there is still a high likelihood that inconsistencies in web browser software will impact a web-based course (Horton, p.115). Because of such things as browser inconsistencies and the multitude of differing computer configurations, it is nearly impossible to test a web site for a course in every possible configuration, it is even less possible to test software to be used in a course for every possible situation that might be encountered.

Undoubtedly, there are some technical problems expected when teaching a course on technology with technology. It is the ultimate goal of internet-based educational systems to be as free from technical problems as can be reasonably expected and to provide timely and appropriate assistance when a problem occurs.

Course Description

The topics covered in the course were a concepts relating to computer operating systems, the Internet, digital image manipulation, digital cameras, QuickTime Virtual Reality authoring, and the introduction of a custom-built website for sharing electronic images and files. There were a total of six major course topics, each with a tutorial module and an assignment to be completed by the participants after working through the tutorial module.

The course was taught by the first and second author of this paper, both of whom had previous experience designing and teaching educational technology courses at the university level in a classroom setting, at a distance via the Internet, and also in training workshops with practicing educators on the topics presented in the course.

During the course, the primary means of communication between the students and the instructors was through of email. The course website featured a form that would send email to both instructors and also the email addresses of both instructors was given on the course website. Students were encouraged to contact the instructors via email if they had any questions, problems, or other needed other assistance.

Assignments in the course were submitted via web-based forms, or alternatively as an attachment to an email message. Of the six assignments that were required in the course, two were primarily text-based information, three assignments required uploading one or more files that were then delivered to the instructors, and the final assignment was to based on the students' ability to successfully use an web-based application for media and file sharing (hereafter referred to as the "Artifact Archive").

Participants

This course was part of a series of online courses and workshops for the teachers involved in a Technology Innovation Challenge Grant program funded by the US Department of Education. Prior to this course, the participants had taken two online courses which used a similar interface and similar course features and attended one three-day workshop, and one two-week workshop involving technology training. There were a total of 51 participants representing 17 school districts in 9 states in the course for the eight week session.

Methodology

The evaluation of this course used two primary sources of information. First, because email was the primary means of communication between students and the instructors, all email communication between students and the instructors was collected. After the course was completed, participants then completed a 67-item course survey that covered multiple aspects of the course. For the purpose of this study, items relating to technical problems encountered and the core content of the course were extracted from the survey data for analysis.

Analysis of Survey Data

The 67-item survey administered following the completion of the course provided information on different aspects of the course, including technical problems encountered. Other information on the survey was not relevant to this study, but will inform other aspects of the course development. The primary items analyzed were the items pertaining to the course tutorial modules and the general course evaluation questions. The tutorial module items asked the participants to rate themselves on their proficiency with the topic before and after the course. The participants were also asked to rate the level of difficulty of each tutorial module and associated assignment, the amount of help needed to complete the module and assignment, and the possibility of using these modules in their classroom. In a following section of the survey, the participants were asked to indicate which modules they found most valuable, least valuable, and which modules they would suggest included in future versions of this course.

From the available survey data, the ratings of "level of difficulty" and "help required" were selected as primary indicators of possible modules where technical problems factored into the success of the course. Also, the indication of which course topics were most valuable, least valuable, and should be included in future version of the course were also examined to further indicate which course topics were most problematic because of technical difficulties. These data would provide initial findings to be confirmed by the analysis of the electronic communications from the course. Additional information was also provided by the survey in the form of comments from the participants. This information was reviewed and used to gauge the overall response of the participants to the course.

Analysis of Email

A coding scheme was developed after the completion of the course to analyze the content of the email messages. Table 1 lists the three levels of coding that were used in the analysis of email messages.

Table 1

Coding Scheme for Participant Email Messages		
Level 1: Message Type	Level 2: Course Topic	Level 3: Detail
▪ Problem ▪ Question ▪ Comment ▪ Other	▪ Operating Systems module ▪ Internet Module ▪ Digital Camera Module ▪ Graphics/Image manipulation module ▪ QuickTime VR module ▪ Artifact Archive module ▪ Multiple modules ▪ General/Other	▪ Submitting Assignment ▪ Using/Installing software ▪ Course administrative ▪ Regarding assignment ▪ Regarding grade/completion ▪ Website Issue ▪ Other

Following the coding of the electronic communication, the analysis was conducted to examine the messages according to the Level 1 groupings. After determining the total number of problems, the messages were then further sorted by the course topic to which they messages were related. This provided information about which course topics seemed to cause the most problems and which course topics caused the fewest. Following the second level categories, the messages were further sorted according to the details of the type of problem encountered. This information provided insight into how the problem might be avoided or corrected in future iterations of the web-based course.

Findings

Level of Difficulty

In assessing the level of difficulty of the course topics, the survey data indicated that the Operating Systems, Internet, and Digital Camera course topics were rated at a low level of difficulty. For each of those course topics, nearly 60% or more of the course participants rated those topics as a 1 or 2 level of difficulty on a 5 point scale, with 1 being not difficult at all and 5 being very difficult. Specifically, for the operating systems, Internet, and Digital Camera modules, 59.5%, 63.6%, and 67.4% respectively rated those modules as a 1 or 2 level of difficulty.

Conversely, the graphics/image manipulation (Mean = 2.36) and the QuickTime VR (Mean = 2.95) course topics had higher ratings for difficulty. Though none of the

mean ratings appear drastically higher or lower than the others, the data indicated that none of the participants rated the Internet, Digital Camera, and Artifact Archive topics at the "very difficult" level. The QuickTimeVR topic had the highest percentage of "very difficult" ratings with 11.4% of the participants and also the highest percentage of ratings of a 4 (25.0%).

Help required

In analyzing the data regarding the amount of help required to complete each course topic, the survey data indicated that the QuickTime VR (Mean = 2.93) and the Graphics/Image Manipulation (Mean = 2.37) course topics ranked highest on a five point rating and the Operating Systems (Mean = 1.86) and Internet/Web Browsing (Mean = 1.69) topics ranked lowest.

Most/Least Valuable topics and Suggestions for future revisions

The third area that was selected as a possible indicator for technical problems was the survey data concerning the most and least valuable course topics and the suggestion for topics to be included in future versions of the course. From the data collected, the QuickTime VR topic ranked highest as the most valuable course topic, followed by the Graphics/Image manipulation and the digital camera topics. The data indicates that the Operating systems topic was the least valuable, followed by the Internet topic. Also, the QuickTime VR, Graphics/Image manipulation, and digital camera topics all were suggested for inclusion in future versions of the course by more than 90% of the respondents.

Results of Analysis of Electronic Communications

During the course, a total of 121 email messages were received that were communication from the course participants to the instructors regarding the course. Since email was also an alternative delivery method for the assignments, those email messages were not considered communication, but rather assignment submissions. Of those messages received, 49 (40.5%) were reporting an instance of a problem encountered while completing the course topics or assignments.

Fifty-one percent of the problems occurred either installing or using the software being taught in the course topics. Also of note is the 28.5% of the problems reported were encountered while submitting an assignment. In looking at those two types of problems that accounted for 79.6% of the total problems reported, it can be seen that 68% of the software installation or use problems were encountered when completing the QuickTime VR topic while the problems while submitting assignments were encountered most with the digital cameras (28.6%) and the artifact archive (42.9%).

Discussion of Results

Perhaps one of the most interesting comparisons of results is that of the number of technical problems reported seemed to have a less significant impact on the suggestions

for inclusion in future versions of the course than expected. For example, the number of technical problems with the Operating Systems and Internet course topics were low; the operating systems tutorial and assignment had only two reported technical problems, while the Internet tutorial and assignment had no problems reported. However, the Operating Systems topic ranked lowest on the suggestion for inclusion in future versions of the course and highest as the least valuable course topic. The Internet topic ranked 4 out of 6 on inclusion in future versions of the course and second as the least valuable topic. The QuickTime VR topic had the most problems reported, but ranked highest for inclusion in future versions of the course.

Other results of interest include the relatively high number of problems while submitting assignments via the course website. Since assignments in this course were primarily submitted via the course website, the problems encountered are a point to be carefully considered.

Conclusions

From the data collected, the overall response to the course topics was positive. Many of the surveys included positive comments regarding the course and no negative comments regarding the course overall were encountered. With regard to technical problems encountered, some conclusions can be made regarding which modules were most problematic and the types of problems that were most common.

The data indicate that the QuickTime VR topic had significant problems with the software used and made available to the participants. Most of the problems encountered in the QuickTime VR topic were related to the software not working properly in some fashion. In many cases reported, this problem was a result of compatibility issues with various computer systems on which it base being used.

The Artifact Archive topic also had significant problems, though no strong common link between the problems seemed apparent. Most of the problems were unable to be replicated or only occurred once. Given that the artifact archive is a web-based file sharing application, it is likely that problems were due to communication issues between the users' computers and the server on which the application was hosted.

A third problem area was in submitting assignments via the course website. Problems reported, other than those in the Artifact Archive, were mostly in completing the digital camera assignment and were reported as uploading errors. The most likely cause of this problem is that the assignment required an upload of several files, some of which were larger files that required a longer time to upload, which can often exceed the time limit for uploading files to the server due to low bandwidth connections.

Implications

This study indicates that there are several improvements that can be made to the course itself to alleviate some of the technical problems encountered. These improvements include procedural improvements for submitting assignments, the choice of software for particular topics, the inclusion or exclusion of some topics in future versions of the course, as well as adjustments to be made to the course to accommodate the various levels of competency in technology encountered.

Procedural improvements to the course will primarily impact the submission of assignments. Over the duration of the course, several problems were encountered submitting assignments. This was most often remedied by asking the participants to submit the assignment files as an attachment to an email message to the instructor. The most likely solution to the problem of assignment submissions is to have all assignments submitted in this fashion where file uploading is necessary. No problems were reported that indicate a problem submitting an assignment as an attachment to an email message. In one case, the email message that was reporting the problem also included the files that were being submitted. To that participant, attaching the files to an email message seemed the best solution without any suggestion from the instructors. In all other cases, attaching the files to an email message was a successful remedy to the problem when suggested by one of the instructors. For that reason, assignments in future versions of the course will be submitted as an attachment to an email message, with the submission via the website remaining available as a backup option for students who might not have access to their email. In cases where uploading via the website is required, the web pages that manage the upload will be arranged to limit the number and size of files that can be uploaded to more appropriate limits to alleviate the problems such as upload script timeouts.

In choosing software to be used in the course for the completion of the tutorials and the assignments, careful consideration must be made to ensure that software is available to all participants and that it is reliable. Clearly there were some pieces of software used that did not meet the essential requirements of stability and availability to be included in future versions of the course.

The survey data provides some compelling information when considering which topics in this version of the course should be included in future versions. According to the survey data, a large number of the participants recommend that the Operating systems and Internet sections be removed from the course. One of the follow-up questionnaires, however, mentions that the Operating Systems topic was necessary. Judging from additional information provided on the survey, it seems that the central issue with the Operating Systems topic and the Internet topic is that these covered basic skills that were already very familiar to the participants. The data concerning level of difficulty from the survey also seem to support that statement. From the instructor's perspective, however, and also supported by the ISTE Technology Standards for Teachers, these two topics are essential and must be available to those who do not have these skills and knowledge. Some of the subtopics in the Operating Systems topic in particular are seen by this author as ultimately valuable for any computer user. With all things considered, it is apparent that the participants in the course should ultimately have some choices in what topics they need to complete, based on their self-assessment of their skills and knowledge.

In general, the implications of the data collected are that the course needs revision to address some of the technical problems. Given the relatively low occurrence of technical problems, only 48 reports of problems, and the indications of the value of the topics covered, it would seem that the course met its overall goals of providing applicable and productive training in specific areas of technology despite the occurrence of some technical problems. Future versions of the course should clearly seek to avoid the technical problems that did occur while maintaining relevant topics and the ability to address the various skill levels of the participants.

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